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Perioperative Assessment of Patients for Non-Cardiac Surgery

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Objectives: At the completion of this presentation, you should be able to:

1. Describe the roles of the medical consultant in perioperative consultation

2. Name and apply principles of risk stratification for patients who are undergoing non-cardiac surgery

3. Assist procedural specialists in assessing perioperative risk in medical patients undergoing non-cardiac surgery

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Evidence Sources:
ACC/AHA 2014 Guidelines on Perioperative Cardiovascular Evaluation and Care for Non-cardiac Surgery, updated

A Report of the American College of Cardiology
American Heart Association Task Force on Practice Guidelines

Circulation. 2014;130:(Aug 1),e278–e333

American College of Cardiology: Applying Classification of Recommendations and Level of Evidence

Class I	Class IIa	Class IIb	Class III
Benefit >>> Risk	*Benefit >> Risk Additional studies with focused objectives needed*	*Benefit ≥ Risk Additional studies with broad objectives needed; Additional registry data would be helpful*	*Risk ≥ Benefit No additional studies needed*
Procedure/ Treatment **SHOULD** be performed/ administered	**IT IS REASONABLE** to perform procedure/administer treatment	Procedure/Treatment **MAY BE CONSIDERED**	Procedure/Treatment should **NOT** be performed/administered **SINCE IT IS NOT HELPFUL AND MAY BE HARMFUL**

Questions about surgery

- What are your roles as the consultant/advisor to the surgeon?
- What are the risks? Sources of risk?
- How do you assess & communicate the risks?
- What are the patient outcomes that matter?
- Other questions?

Consultant etiquette

DO

- "Is an acceptable risk"
- Reporting & discussing your findings with the requesting surgeon
- Be thorough but focus on what matters for the surgery
- "Definitive, prioritized and precise" recommendations
- Pick up the phone, speak directly with surgical team
- Follow up & continue to monitor **for changes**

DON'T

- "Medically cleared"
- Sharing your assessment & determination of risk with the patient
- Exhaustive H & P

- "Rambling" recommendations
- Relying solely on chart documentation
- Quick sign off, when co-management is requested

(Source: Up to Date)

The History of Risk Factor Prediction in Non Cardiac Surgery

Lee Goldman, MD

- NEJM (1977)
- The value of resident research
- “Goldman criteria”
- Revised Cardiac Risk Index

The Original Goldman Criteria

Criteria (Risk)	Points
S3 gallop or JVD on exam (active CHF)	11
MI in previous 6 months	10
PVC's> than 5/min at any time before operation #	7
Rhythm other than sinus or PAC's on last ECG #	7
Age > than 70	5
Emergency operation	4
Poor general health (PaO2 < 60, PaCO2 > 50, K + <3, HCO3 < 20, BUN > 50, Cr > 3, elevated transaminases, signs of chronic liver disease or patient bedridden from non-cardiac causes)	3
Important valvular aortic stensois	3
Intraperitoneal, intrathoracic, or aortic surgery	3

(Note # : Only counted if underlying CV disease present)

(NEJM 1977;297:845-850)

Validation and cardiac risk stratification for Goldman's criteria leading to the Revised Cardiac Risk Index

		Risk for Life Threatening Cardiac Complication Or Death	
Class	**Point Total**	**Combined Incidence**	**Range**
I	0-5	1.6%	1-7%
II	6-12	5%	3-11%
III	12-25	16%	14-38%
IV	25-53	56%	30-100%

(Lee, et al, NEJM 1977;297:845-850)

Revised Cardiac Risk Index (RCRI)

1. History of CHF
2. History of ischemic heart disease
    - (history of MI or a positive exercise test, current complaint of chest pain considered to be secondary to myocardial ischemia, use of nitrate therapy, or ECG with pathological Q waves; do not count prior coronary revascularization procedure unless one of the other criteria for ischemic heart disease is present)
3. Vascular type of surgery (includes any intraperitoneal, intrathoracic, or suprainguinal vascular procedures)
4. Preoperative serum creatinine >2.0 mg/dL
5. Diabetes mellitus requiring treatment with insulin
6. History of cerebrovascular disease

Rates of death, non-fatal MI & non-fatal cardiac arrest, based on Revised Cardiac Risk Index

- 0 risk factors = 0.4 percent
  (95% CI 0.1-0.8 percent)
- 1 risk factor = 1.0 percent
  (95% CI 0.5-1.4 percent)
- 2 risk factors = 2.4 percent
  (95% CI 1.3-3.5 percent)
- 3 or more risk factors - 5.4 percent
  (95% CI 2.8-7.9 percent)

(Deveraux et al., CMAJ 2005)

Summary: Sources of risk for the patient facing surgery

Related to the surgery

- Emergent surgery = higher risk
- Vascular surgery = higher risk

Related to the patient

- Active Cardiac Conditions
- Clinical factors (RGCI)
- Functional capacity of the patient: based on activity level in METs

Mr. Vandermeer

A 71 y.o. male, is sent to you by his orthopedic surgeon for pre-operative assessment prior to elective hip replacement surgery.

- His problem list includes a history of: HTN, type II DM Obesity (BMI=30), high cholesterol, DJD of his knees and hips and CKD, stage III (sCr=1.6, GFR=55).
- One hospital admission 6 years ago for accelerated HTN, complicated by mild heart failure. Since then, he has seen you regularly for HTN management, and his BP's have been well controlled. He has not had any episodes of heart failure since.
- Surgical hx: T & A as a child, hernia repair 20 years ago.
- SH: Smokes 5-7 cigarettes a day. ETOH: 1-2 beers on a weekend

Mr. V: (cont'd)

- Meds: Lisinopril/Hctz 20/25 mg 1daily, Metoprolol succinate (Toprol XL) 50 mg qD, Metformin 1000 mg BID, glipizide 5 mg BID, meloxicam 15 mg daily, ASA 81 mg daily; simvistatin 20 mg daily
- ROS: CV-denies any CP, SOB, orthopnea; he does get winded walking up >1 flight of steps or walking uphill with no recent change in symptoms and no angina ; MSK--activity is limited by hip pain; EXT—no edema; no weight gain recently
- Data review:
  - Echocardiogram 9 months ago which showed an EF =55%, mild LVH, impaired diastolic relaxation, mild MR.
  - Glucose is 140; LDL =145; HgbA1C = 7.2

Physical Exam is unremarkable except for:

VS: BMI =30; BP = 156/95; P=72

Overweight w male.

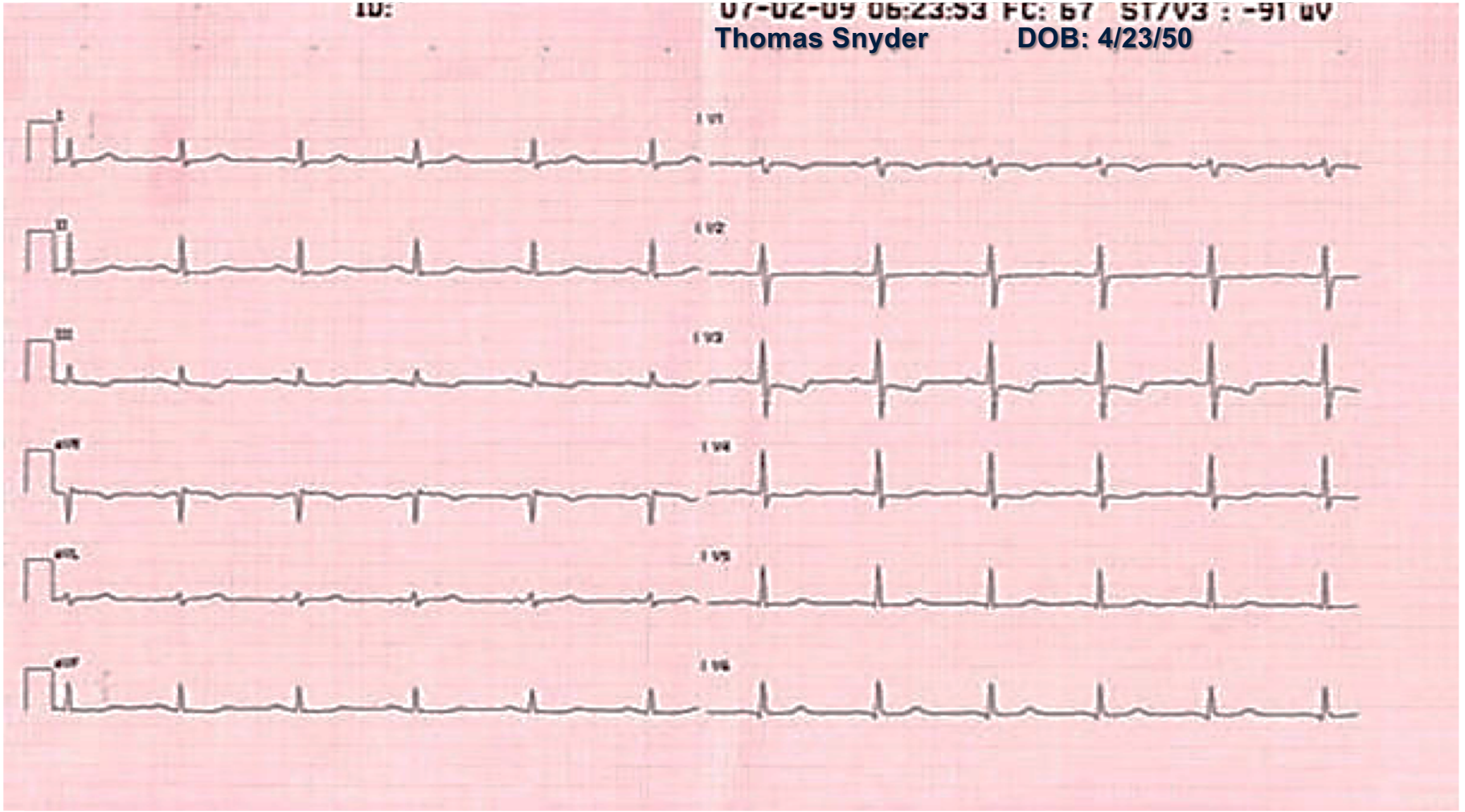
Heart: Regular rhythm, Gr 1/6 mid systolic murmur at the LSB

Ext: no edema, peripheral pulses are

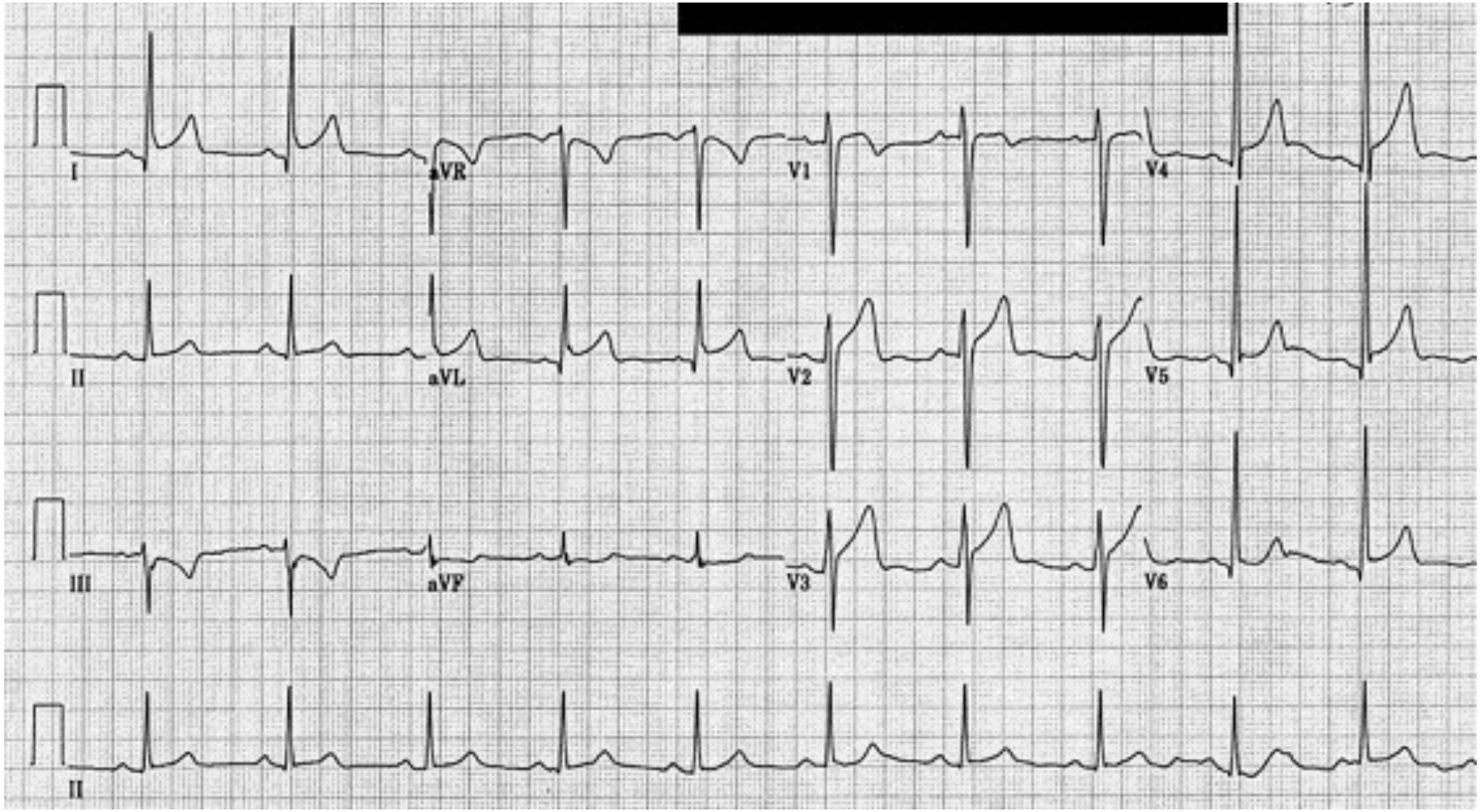
+1 posterior tib., tr/4 dorsalis pedis bilaterally

Monofilament exam shows reduced sensation

EKG



Mr. V's EKG



NSR, 62 bpm. Normal axis, J point elevation in I and AvL, no ST-T changes. Voltage criteria for LVH.

You recommend to Mr. V that he…

A) Proceed with the planned procedure

B) Have further testing which will allow you to better assess his risk for medical complications

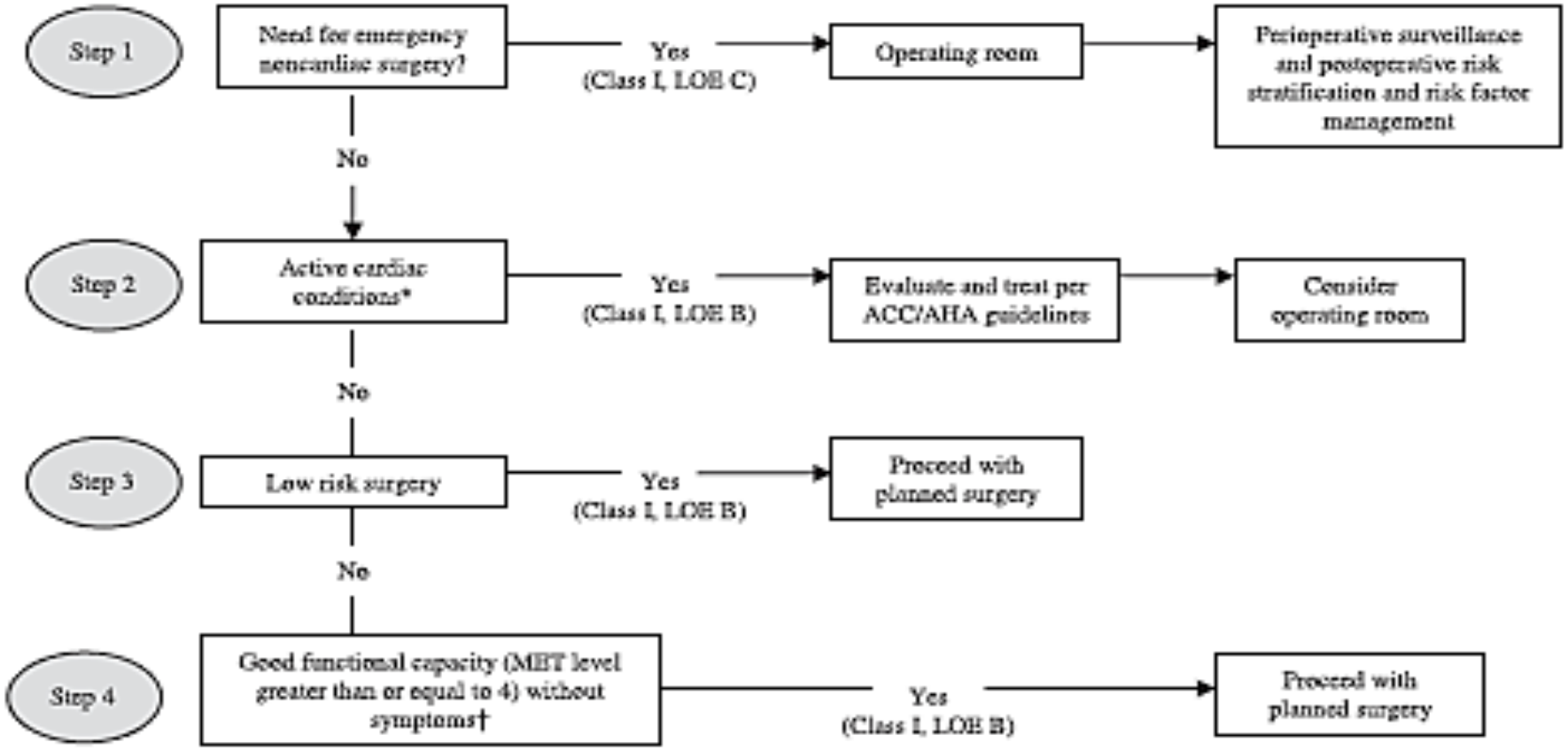
C) Cancel his surgery as it would be too dangerous

D) Should contact his attorney to “put his affairs in order”

Mr V: What more do we need to know for him to proceed safely?

- What additional history you would like?
- Anything on exam that would demand your attention or influence your decision-making right up front?
- Would you order any additional studies?
- What criteria will you use to estimate his surgical risk?

Let's assess Mr. V's risk, using the ACC step-wise approach



(Source: ACC Guidelines, 2007)

Risk assessment: A step-wise approach

1. Urgent or emergent surgery?
   - Mortality rates were 5% at 30 days, 12% after 1 year--*Compare with Goldman rates of 1-5%*
   - The high initial death rate continued for about 100 days after surgery.

(Neary, Annals of the Royal College of Surgeons of England, 2006: vol. 88, no2, pp. 151-156)

Risk assessment: Step 2
Are there any “active cardiac conditions”?

–Mnemonic:
CALVINooo!

- Active CONGESTIVE HEART FAILURE
- Significant ARRYTHMIAS
- Lousy VALVES
- ISCHEMIA
  - unstable angina, MI within 30 days

NO SURGERY!

Active Cardiac Conditions for Which the Patient Should Undergo Evaluation and Treatment Before Noncardiac Surgery

Condition	Examples
Unstable coronary syndromes *	▪ Unstable or severe angina* (CCS class III or IV)† ▪ Recent MI‡
Decompensated HF *	▪ NYHA functional class IV; ▪ Worsening or new-onset HF
Significant arrhythmias	▪ High-grade atrioventricular block ▪ Mobitz II atrioventricular block ▪ Third-degree atrioventricular heart block ▪ Symptomatic ventricular arrhythmias ▪ Supraventricular arrhythmias (including atrial fibrillation) with uncontrolled ventricular rate (HR > 100 bpm at rest) ▪ Symptomatic bradycardia ▪ Newly recognized ventricular tachycardia
Severe valvular disease	▪ Severe aortic stenosis (mean pressure gradient greater than 40 mm Hg, aortic valve area less than 1.0 cm2, or symptomatic) ▪ Symptomatic mitral stenosis (progressive dyspnea on exertion, exertional presyncope, or HF)

(* = were part of the original Goldman criteria)

Note: simple VPC's & APC's not on this list

CCS indicates Canadian Cardiovascular Society; HF, heart failure; HR, heart rate; MI, myocardial infarction; NYHA, New York Heart Association. *According to Campeau.[10] †May include stable angina in patients who are unusually sedentary. ‡The ACC National Database Library defines recent MI as more than 7 days but within 30 days)

Risk assessment: A step-wise approach

3. *Risk related to type of surgery*

- What procedure is Mr. V having?

Cardiac Risk Stratification for Non Cardiac Surgical Procedures

- **High (Cardiac risk > 5%)**: emergent major operations, aortic and other vascular, peripheral vascular, prolonged surgical procedure with associated with large fluid shifts or blood loss

- **Intermediate (Cardiac risk 1-5%)**: Carotid endarterectomy, intraperitoneal and intrathoracic surgery, head and neck, orthopedic and prostate

- **Low (Cardiac risk < 1%)**: endoscopic procedures, superficial procedures, cataract, breast

Risk assessment: A step-wise approach

4. *Functional Capacity*:

- Based on activity level, capability to physical exertion (as estimated in METs)

- Mr V: + DOE with >1 flight of steps and with walking up a hill

Estimated Energy Requirements for Various Activities

	Can You…
1 Met	Take care of yourself?
	Eat, dress, or use the toilet?
	Walk indoors around the house?
	Walk a block or 2 on level ground at 2 to 3 mph (3.2 to 4.8 kph)?
4 Mets	Do light work around the house like dusting or washing dishes?

	Can You…
4 Mets	Climb a flight of stairs or walk up a hill?
	Walk on level ground at 4 mph (6.4 kph)?
	Do heavy work around the house like scrubbing floors or lifting or moving heavy furniture?
	Participate in moderate recreational activities like golf, bowling, dancing, doubles tennis, or throwing a baseball or football?
≥ 10 Mets	Participate in strenuous sports like swimming, singles tennis, football, basketball, or skiing?

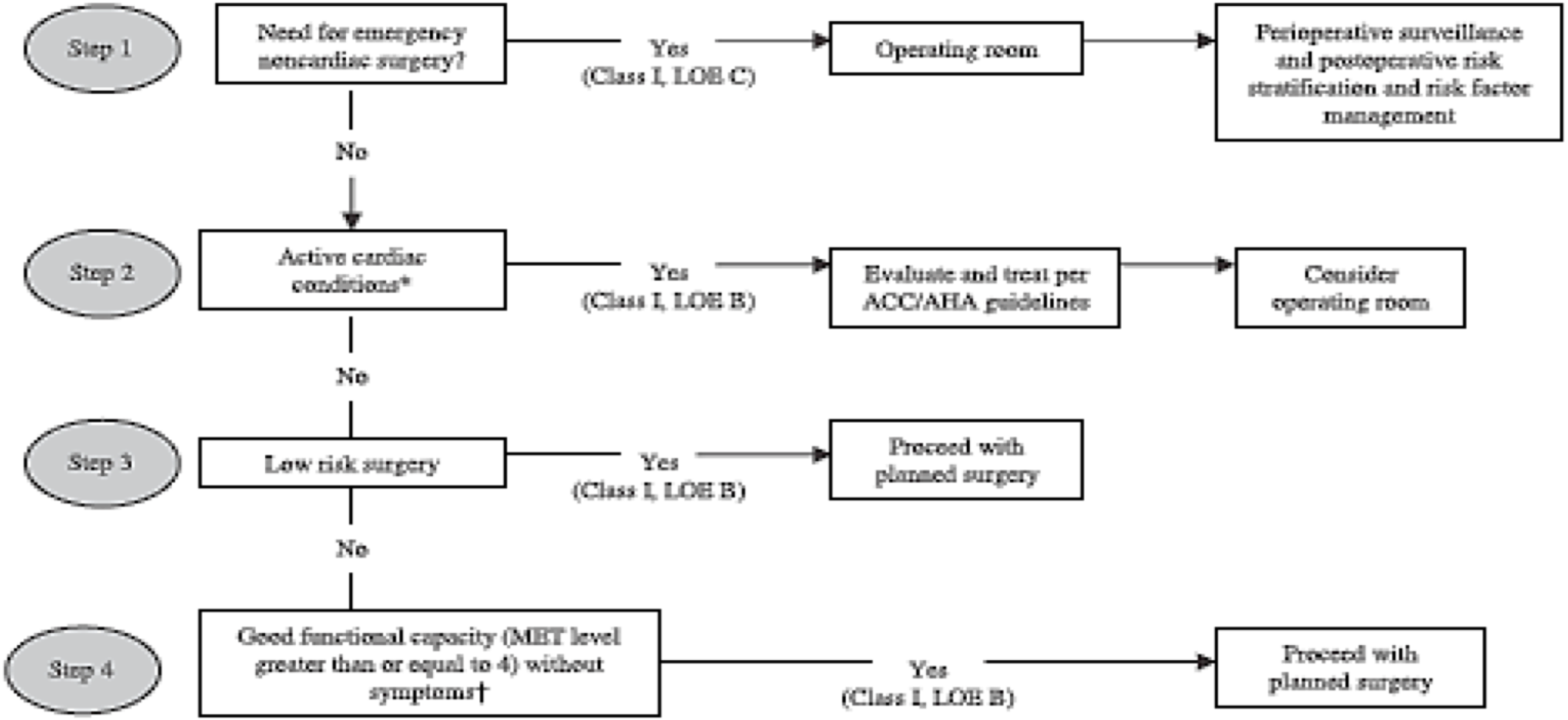
indicates metabolic equivalent; mph, miles per hour; kph, kilometers per hour. *Modified from Hlatky et al,11 copyright 1989, with permission from Elsevier, and adapted from Fletcher et al.12

Table 4. Duke Activity Status Index

Activity	Weight
Can you…	
1. take care of yourself, that is, eating, dressing, bathing, or using the toilet?	2.75
2. walk indoors, such as around your house?	1.75
3. walk a block or 2 on level ground?	2.75
4. climb a flight of stairs or walk up a hill?	5.50
5. run a short distance?	8.00
6. do light work around the house like dusting or washing dishes?	2.70
7. do moderate work around the house like vacuuming, sweeping floors, or carrying in groceries?	3.50
8. do heavy work around the house like scrubbing floors or lifting or moving heavy furniture?	8.00
9. do yardwork like raking leaves, weeding, or pushing a power mower?	4.50
10. have sexual relations?	5.25
11. participate in moderate recreational activities like golf, bowling, dancing, doubles tennis, or throwing a baseball or football?	6.00
12. participate in strenuous sports like swimming, singles tennis, football, basketball, or skiing?	7.50

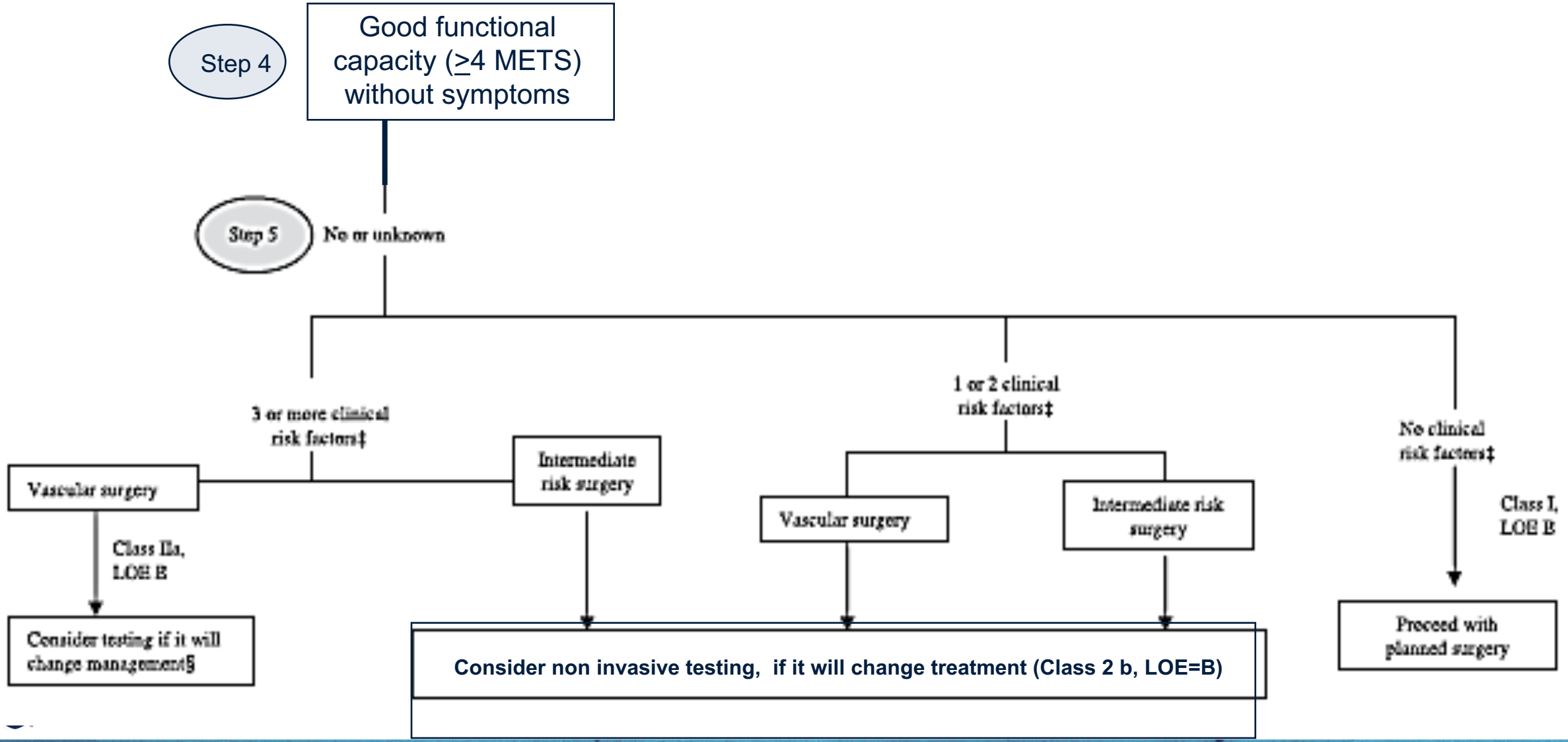
Reproduced with permission from Hlatky et al.[133]

Now, let's reassess Mr. V's risk



(Source: ACC Guidelines, 2007)

Cardiac evaluation and care algorithm for non-cardiac surgery



Risk assessment: A step-wise approach

5. *Counting clinical risk factors*

- "CHARDS" (Revised Cardiac Risk Index): most important—what are they?
  - **CHF, "Angina" (active ischemia), Renal, Diabetes, Stroke** + Intermediate risk surgery (supra-inguinal, abdominal, thoracic)
- Other ("minor") risk factors:
  - Advanced age (>70)
  - Abnormal ECG
  - Rhythm other than sinus
  - Uncontrolled systemic hypertension
- What traditional cardiac risk factor is noticeably absent?

Mr. Vandermeer's risk summary

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- His problem list includes a history of: HTN, type II DM Obesity (BMI=30), high cholesterol, DJD of his knees and hips and CKD, stage III (sCr=1.6, GFR=55). Knee pain limits physical activity to < 4 METS
- One hospital admission 6 years ago for accelerated HTN, complicated by mild heart failure. Regular follow up since then, & his BP's have been well controlled. He has not had any episodes of heart failure since.
- Echocardiogram 9 months ago showed an EF =55%, mild LVH, impaired diastolic relaxation, mild MR.
- SH: Smokes 5-7 cigarettes a day. ETOH: 1-2 beers on a weekend

Proceed to surgery?

Mr. V: What testing should he have?

- Another ECHO?
- A stress test? If so, which type?

Recommendations for Preoperative Noninvasive Evaluation of LV Function

- **Class I** (none)
- **Class IIa**
  - It is reasonable for patients with dyspnea of unknown origin to undergo preoperative evaluation of LV function. (C)
  - It is reasonable for patients with current or prior HF with worsening dyspnea or other change in clinical status to undergo preoperative evaluation of LV function if not performed within 12 months. (C)
- **Class IIb**
  - Reassessment of LV function in clinically stable patients with previously documented cardiomyopathy is not well established. (C)
- **Class III**
  - Routine perioperative evaluation of LV function in patients is not recommended. (B)

Recommendations for Noninvasive Stress Testing Before Non-cardiac Surgery

- Class I: Patients with active cardiac conditions in whom non-cardiac surgery is planned should be evaluated and treated per ACC/AHA guidelines before non-cardiac surgery. (B)
- Class IIa: Noninvasive stress testing of patients with 3 or more clinical risk factors and poor functional capacity (less than 4 METs) who require vascular surgery is reasonable if it will change management. (B)
- **Class IIb: Noninvasive stress testing may be considered for patients:**
  - **With at least 1 to 2 clinical risk factors and poor functional capacity (less than 4 METs) who require intermediate-risk non-cardiac surgery *if it will change management*. (B)**
  - With at least 1 to 2 clinical risk factors and good functional capacity (greater than or equal to 4 METs) who are undergoing vascular surgery. (B)
- Class III: Noninvasive testing is not useful for patients:
  - With no clinical risk factors undergoing intermediate-risk noncardiac surgery. (C)
  - Undergoing low-risk noncardiac surgery. (C)

Mr V. had….

A pharmacologic, nuclear stress test which was negative for ischemia with a hypertensive BP response, estimated ejection fraction of 55%

- **Noninvasive testing has a negative predictive value of almost 100 percent for perioperative death or nonfatal MI but a positive predictive value of less than 20 percent (eg, 98 and 18 percent, respectively in a review of five studies of dipyridamole-thallium imaging.** (Up to Date, 2009)

- Is he “an acceptable risk” for the planned procedure?
- Do you have any suggestions for the surgeon for his perioperative management?
- What about his BP (156/95)?
  - **He’s on lisinopril/hctz 20/25 mg, metoprolol succinate 50 mg**

Other risk stratification models (See Qx Calculate by QxMD)

American College of Surgeons NSQIP
American Society of Anesthesiologists

Gupta perioperative Cardiac Risk
Geriatric Sensitive Periop Risk Index

	RCRI (131)	American College of Surgeons NSQIP MICA (115)	American College of Surgeons NSQIP Surgical Risk Calculator (114)
Use outside original cohort	Yes	No	No
Sites	Most often single-site studies, but findings consistent in multicenter studies	Multicenter	Multicenter
Outcome and risk factor ascertainment	Original: research staff, multiple subsequent studies using variety of data collection strategies	Trained nurses, no prospective cardiac outcome ascertainment	Trained nurses, no prospective cardiac outcome ascertainment
Calculation method	Single point per risk factor	Web-based or open-source spreadsheet for calculation (http://www.surgicalriskcalculator.com/miorcardiacarrest)	Web-based calculator (www.riskcalculator.facs.org)

BMI indicates body mass index; COPD, chronic obstructive pulmonary disease; CPT, current procedural terminology; ENT, ear, nose, and throat; HF, heart failure; NSQIP MICA, National Surgical Quality Improvement Program Myocardial Infarction Cardiac Arrest; NSQIP, National Surgical Quality Improvement Program; RCRI, Revised Cardiac Risk Index; TIA, transient ischemic attack; and ..., not applicable.

Summary

Estimate & communicate the patient's risk

- Type of surgery: emergent or vascular = higher risk
- Active cardiac problems = higher risk
- Surgical procedure risk: low, intermediate, high
- Functional capacity of the patient, based on activity level (<4 METS = higher risk)
- If intermediate surgical procedure and poor functional capacity, assess patient clinical factors (Revised Cardiac Risk Index = "CHARDS") and test if result will influence management

Summary of Approach

- Patients at *low risk* : generally require no further evaluation before surgery, as long as
  - **No active cardiac conditions**
  - **Low risk surgery**

- Patients at *high risk* (eg, vascular surgery in other than low risk patients, signs or symptoms of severe or unstable coronary disease) usually undergo additional evaluation by cardiologists

- Patients at *intermediate risk* represent a heterogeneous group that includes those at low and high risk. The use of noninvasive testing can be used to identify the risk category of an individual patient, esp if limited functional capacity.

Questions?

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Coding for services

- As a consultant, you use the same inpatient or outpatient E & M codes that you would if you were providing the care
- Office consultations:99202-99205 (new), 99212-99215 (established)
  - PF, EPF, Detailed w/mod complexity, Comp. w/ high complexity
- Inpatient consultations: 99221-99223 (if new), 99231-99233 (if established)
  - Comprehensive with low, mod, high complexity
- Including the name, specialty of the doctor who has requested the consult may help your staff

A Few Words about Beta-blockers

- The 2007 ACC guidelines favored using beta-blockers in patients who have a history of ischemic heart disease or stable angina
  - Rationale: B-blockers reduce workload of the heart, prevent angina in susceptible individuals

- Since then, evidence has emerged that has required a re-thinking of this strategy

Perioperative beta blockers:
Meta-analysis (2008)

- 33 trials, 12,306 patients
- No significant reduction in all cause mortality, cardiovascular mortality, heart failure
- Decrease in non-fatal MI (NNT=63) and myocardial ischemia (NNT=16) at the expense of:
- Increased risk of non-fatal strokes (NNH=293)
- B-blockers associated with high risk of perioperative
  - **Bradycardia requiring treatment (NNH=22)**
  - **Hypotension (NNH=17)**

(Bangalore et al, Lancet, 2008 Nov 11; 372: 1962-1976)

Peri-operative beta-blockers: Take home points

- “Routine administration of high-dose beta blockers in the absence of dose titration is not useful and may be harmful to beta-blocker-naive patients undergoing surgery." **(ACC/AHA, 2009 Update)**

- OK to continue in those who have been on them for several weeks, as part of their regular regimen.
  - They do not have to be discontinued, provided that the patient has not had problems with orthostatic hypotension, symptomatic bradycardia or high grade cardiac conduction problems

ACC/AHA 2009 Update on B-blockers in vascular surgery

- Beta blockers are reasonable to consider in:
  - patients at high risk for heart attacks or other cardiac complications because of abnormal stress test results or known coronary artery disease who undergo vascular surgery (IIa, C)
    - Careful titration to BP and HR necessary
  - high-risk patients undergoing intermediate risk surgery or in those with multiple risk factors for complications, such as diabetes, a history of heart failure or significant kidney disease, who undergo vascular surgery (IIb, C)
- Hot area for research, discussion
  - Stayed tuned, keep reading

Pulmonary Risk Factors

- Age >50 years
- Chronic obstructive lung disease
- Congestive heart failure
- Poor general health status as defined by ASA class >2
- Functional dependence
- Serum albumin <35 gm/L
- Upper abdominal, thoracic, aortic, head and neck, neurosurgery, and abdominal aortic aneurysm surgery
- Surgery lasting greater than three hours
- Emergency surgery
- Use of pancuronium as a neuromuscular blocker

(Source: Up to Date, 2009, based on several studies cited within)

Maximizing Pulmonary Function Pre-operatively

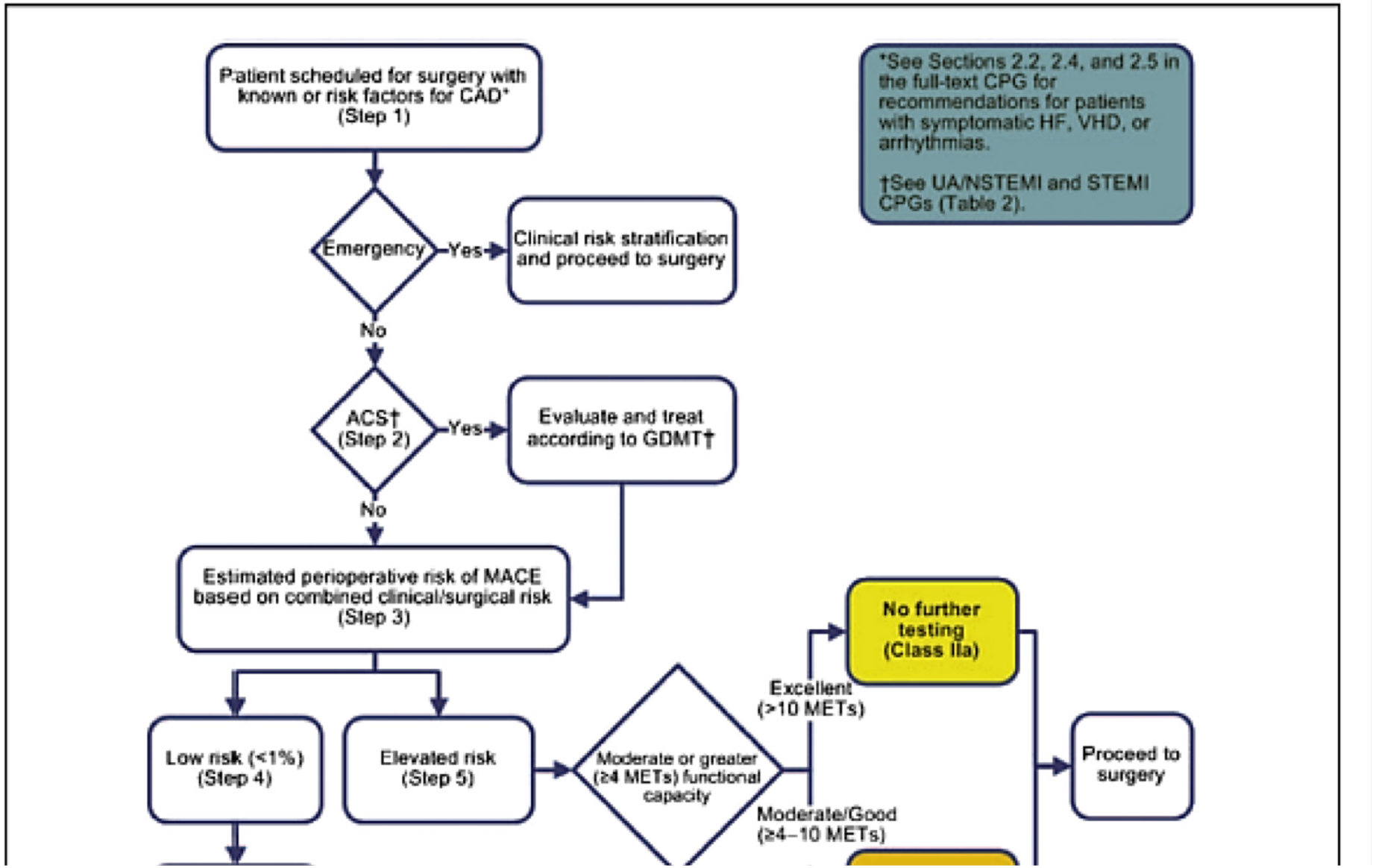
- Smoking cessation for eight weeks
- Inhaled anticholingic for all patients with clinically significant COPD
- Inhaled beta-agonists for patients with COPD or asthma who have wheezes or dyspnea
- Preoperative glucocorticoids for patients with COPD or asthma who are not optimized and whose airway obstruction has not been maximally reduced
- Delay elective surgery if respiratory infection present
- Antibiotics for patients with infected sputum
- Preoperative inspiratory muscle training

(Source: Up to Date, 2009)

ACC Guideline

Algorithm

First steps



Assuming

Non emergent
&
No ACS

Next Steps

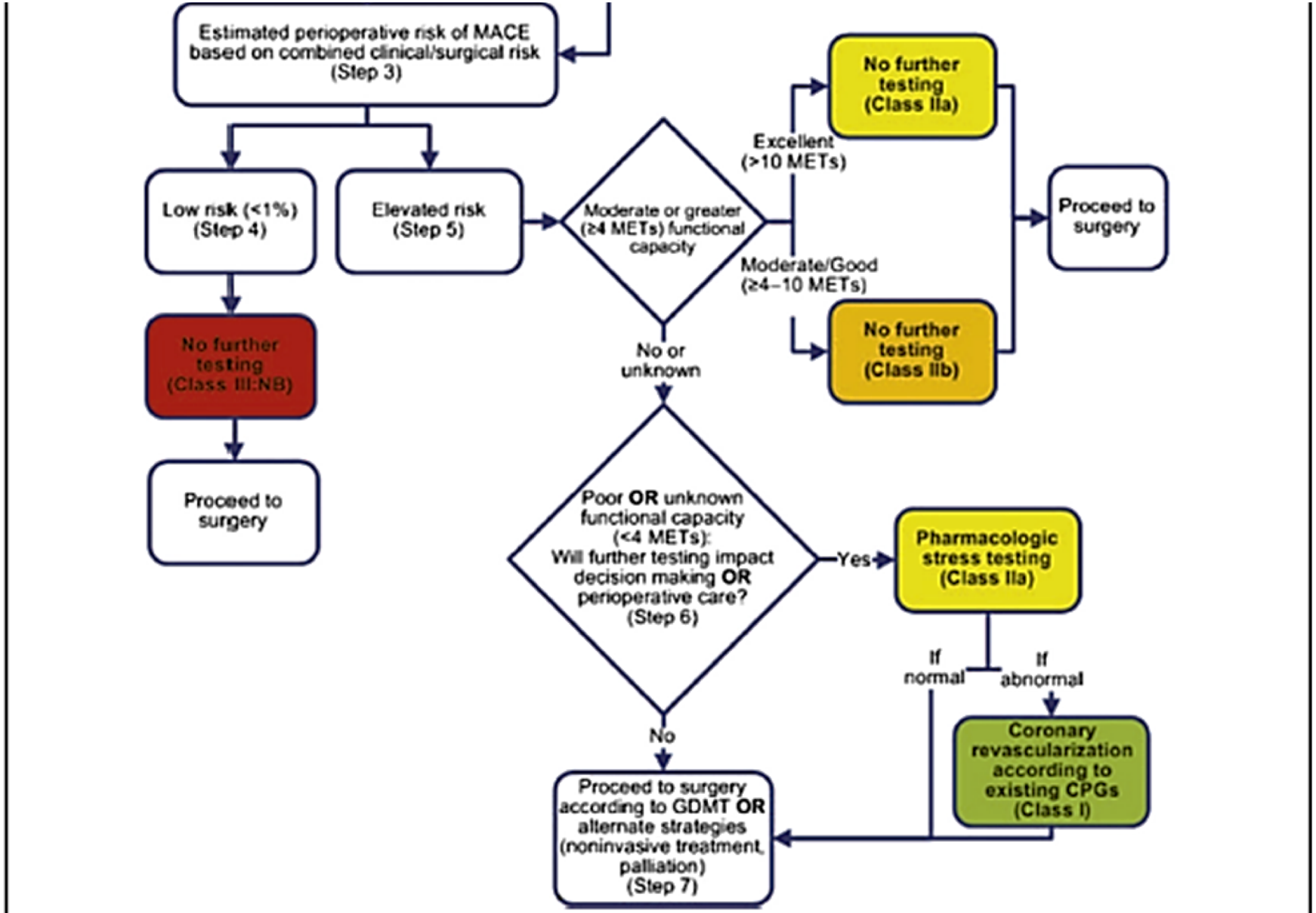


FIGURE 1 Stepwise Approach to Perioperative Cardiac Assessment for CAD